

Australian Motor Vehicle Certification Board

Installation and location of aftermarket in-vehicle visual display unit devices

Guidelines

In-Vehicle VDU Devices Working Group

2017

Preface

The *In-Vehicle VDU Devices Working Group*, which developed these guidelines, comprises representatives from state and territory transport authorities and the National Heavy Vehicle Regulator (NHVR). The Working Group is chaired by the WA Department of Transport and reports to the Australian Motor Vehicle Certification Board (AMVCB).

Note:

- These guidelines are freely available for personal or commercial use, reproduction and distribution. However, no permission is given to amend or alter the guidelines in any way.
- All diagrams contained in this document are for illustrative purposes only and are not drawn to scale.
- Although these guidelines have been compiled with all due care and available knowledge, it is not possible to foresee all situations or hazards and it is always incumbent on the user to exercise appropriate care and common sense. Consequently, no responsibility is taken for any injury or loss incurred due to any unsafe installation, even if it complies with these guidelines.
- Although these guidelines have no legal force, they may be incorporated or referenced in law by individual jurisdictions.
- The standards and criteria in these guidelines may be subject to change or clarification and it is recommended that you check the website on which the document is provided to ensure you have the most current copy.

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1. Background

In recent years, the increasing availability of relatively low-cost, portable electronic devices with Visual Display Units (VDUs) has led to a substantial increase in the use of these devices in vehicles. Devices such as Digital Video Disc (DVD) screens and reversing cameras can generally be installed in a motor vehicle without specific approval.

However, only devices that are considered driver's aids are allowed to be visible to the driver while the vehicle is in operation.

Note: A number of these VDU devices are designed to assist the driver of the vehicle and are therefore considered a driver's aid. Other units (or non-driver's aids) are designed for entertainment purposes, which can cause dangerous distractions to the driver and other vehicle operators.

For other types of devices, no part of the device's image screen may be visible to the driver in the normal driving position, unless the display is automatically disabled or placed in a position that is hidden from the driver while the vehicle is in operation.

Concern about safety issues, in light of the rapidly increasing use of these devices, has led to discussions at a national level, through forums such as the Australian Motor Vehicle Certification Board (AMVCB). As a result, the national In-Vehicle VDU Devices Working Group was convened to develop these guidelines.

2. Issues

The installation of VDU devices in vehicles carries potential road safety risks regarding:

- distraction for the driver of the vehicle in which the VDU is fitted as well as the drivers of any nearby vehicles who can see the display.
- obscuring the driver's view of their surroundings and/or instruments and controls in the vehicle.
- obscuring or interfering with safety equipment, such as air bags.
- causing impact with the driver's or passenger's head or other parts of their bodies in the event of a crash.

- becoming dislodged from its mounting and either causing a distraction to the driver during normal driving or becoming a dangerous projectile during a crash.

All of the above safety issues are affected by the design, installation and location of the device. However, in most or all cases, there are measures that can be taken to reduce the risk (e.g. by using an alternative location for the device).

One of the difficulties in introducing regulatory standards in this area is trying to cater for the wide and increasing range of devices and technologies on the market. Accordingly, the introduction of guidelines and principles for the safe fitment of these devices is seen as a more effective approach than introducing prescriptive regulations.

3. Scope

These guidelines apply to the installation and location of all aftermarket in-vehicle VDU devices, including:

- devices fitted to light or heavy vehicles
- devices permanently mounted or temporarily mounted
- driver's aids or non-driver's-aids (as applicable).

Note: Certain aspects of these guidelines are only applicable to driver's aids, but other aspects (e.g. non-intrusion into the head strike zone) are applicable to all types of devices.

4. Regulatory considerations

The regulations and standards applying to VDU devices are aimed at ensuring that devices:

- are safely installed (so as not to cause an unacceptable safety risk).
- do not cause any distraction or any other degradation of the driving task for the driver of the vehicle or other drivers.

Australian Design Rule (ADR) 21/00 – Instrument Panel defines a number of requirements for the safety of the interior of vehicles (including requirements relating to sharp edges etc.). The vehicle standards regulations in state and territory jurisdictions require continued compliance with all relevant ADR requirements.

The vehicle standards requirements in state and territory jurisdictions are consistent with (and in some cases refer directly to) the *Heavy Vehicle National Law (HVNL)*, administered by the National Heavy Vehicle Regulator (NHVR), as well as the *Australian Light Vehicle Standards Rules 2015*, administered by the National Transport Commission (NTC). Although a number of provisions in these bodies of law may affect the installation of VDU devices in various contexts, the most relevant provisions are as follows:

Driver's view and vehicle controls

A motor vehicle must be built:

- (a) *to allow the driver a view of the road and of traffic to the front and sides of the vehicle so the driver can drive the vehicle safely; and*
- (b) *with its controls located so the driver can drive the vehicle safely.*

Television receivers and visual display units

- (1) *A television receiver or visual display unit must not be installed in a vehicle so any part of the image on the screen is visible to the driver from the normal driving position.*
- (2) *However, subrule (1) does not apply to:*
 - (a) *a television receiver or visual display unit that cannot be operated when the vehicle is moving*
 - or
 - (b) *a driver's aid in any vehicle or a destination sign in a bus.*

Examples of driver's aids:

 - (c) *Closed-circuit television security cameras*
 - (d) *Dispatch systems*
 - (e) *Navigational or intelligent highway and vehicle system equipment*
 - (f) *Rear view screens*
 - (g) *Ticket-issuing machines*
 - (h) *Vehicle monitoring devices.*
- (3) *A television receiver, or visual display unit, and its associated equipment in a vehicle must be securely mounted in a position that:*
 - (a) *does not obscure the driver's view of the road; and*

- (b) *does not impede the movement of a person in the vehicle.*

Protrusions

An object fitted to a vehicle must be designed, built and fitted to the vehicle in a way that minimises the likelihood of injury to a person making contact with the vehicle.

5. Guidelines

The following guidelines are based on guidelines developed by the European Commission (EC) between 1998 and 2008, and these have been enhanced to address additional issues and developments in vehicle technology. The EC reports are cited in the *References* section.

Note: If any of the following guidelines are in conflict with regulatory requirements, then the regulatory requirements must take precedence.

VDU device installation

The VDU device must be located and securely fitted in line with all of the manufacturer's instructions for installing the system in vehicles.

Explanation:

Manufacturers design products for an intended environment and use. If the manufacturer's installation instructions are not followed, this may cause the VDU device to be installed in a way that was not intended by the manufacturer, which could have negative safety consequences.

For example, the device may become detached from its mounting during vehicle operation, causing a driver distraction that could result in a crash.

During a crash, all of the items (including any VDU devices) within the vehicle are momentarily subjected to forces of many times their own weight. Consequently, during a crash a VDU device may break free of its mountings and become a dangerous projectile within the vehicle.

To provide protection against this danger, a VDU device must be secured in accordance with the manufacturer's instructions, using the mounting provided by the manufacturer (if one is supplied).

Requirements:

In addition to installing the device in line with all regulatory requirements, all aspects of the manufacturer's instructions must be followed. This includes all instructions relating to the location, mounting and electrical connection of the device, as well as the use of any manufacturer-supplied mounting.

If no mounting or mounting instructions are provided, then it is the responsibility of the installer to provide a mounting arrangement with adequate strength.

Examples:

✓ **Good:** A dispatch information system securely fitted to the dashboard in accordance with all required standards, regulations and manufacturers' instructions.

✗ **Bad:** A Global Positioning System (GPS) fixed to the dashboard with a poor quality temporary fastening (such as adhesive tape) rather than the bracket supplied by the manufacturer.

Driver's aids and driver's normal line of sight

VDU displays that are driver's aids should be positioned as close as practicable to the driver's normal line of sight.

Note: This guideline applies to driver's aids only, as non-driver-aids must not be visible to the driver during vehicle operation.

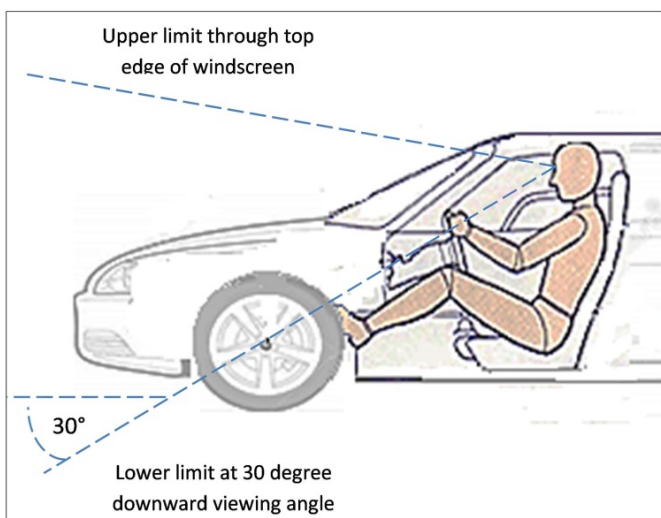


Figure 1: Correct vertical placement of displays

Explanation:

For a driver to be in full control of the vehicle and aware of the dynamic road situation, it is essential that, apart from brief glances at mirrors or instrumentation, the driver's gaze should be directed towards the road and surrounds.

VDU displays positioned close to the normal line of sight reduce the total eyes-off-the-road time relative to those which are positioned further away. This position maximises the possibility for a driver to use peripheral vision to monitor the road scene for major developments while looking at a display.

The further the display is positioned away from the driver's normal line of sight, the longer it takes to read and the greater the possible impact on driving performance.

Requirements:

All displays containing information relevant to driving must be placed:

- **vertically:** no point on the VDU display shall be higher than the top edge of the windscreen or lower than a 30° downward viewing angle of the driver's normal forward view (see *Figure 1*)
- **horizontally:** no point on the VDU display shall be left of the left most point on the central rear view mirror or rearward of the dashboard on the driver's side (see *Figure 2*).

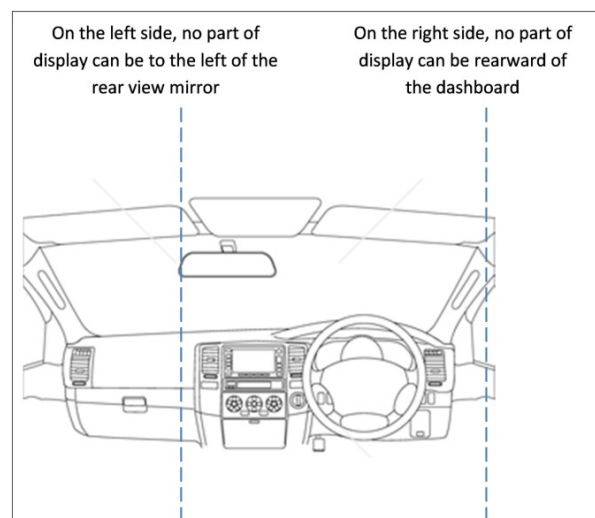


Figure 2: Correct horizontal placement of displays

These requirements must be balanced against the requirement:

- not to obstruct the road scene
- not to obstruct other controls or displays
- that the display itself should not be substantially obstructed by, for example, controls such as the steering wheel or gear change lever.

Examples:

✓ **Good:** A mobile phone running a navigation program is securely mounted with suction cups along the bottom of the driver's side of the windscreen. The location of the phone causes no obstruction to the driver's frontal view of the road, but is within the 30° downward viewing angle.

✗ **Bad:** A VDU navigation device that is mounted beneath the glove box of the vehicle, requiring the driver to look downwards and to the left to see the navigation display.

Obstruction of driver's critical view

No part of the VDU can obstruct the driver's critical view of the road and surroundings.

Explanation:

An adequate view of the road and surroundings is essential for safe performance of the driving task. The 'driver's view' should be interpreted as pertaining to the forward view directly through the windscreen, and the side views and rear view, either directly or indirectly.

However, an adequate view does not necessarily imply that all parts of the vehicle glasswork must be unobscured, as there are critical and non-critical view areas.

The following principles are to be used to determine whether the driver has an adequate view to safely drive the vehicle (i.e. that none of the critical view areas are obscured).

Requirements:

View through the windscreen

Devices are only permitted to obstruct the driver's view through the upper or lower non-critical windscreen areas, which are defined below.

Therefore:

- A device mounted to the inside of the windscreen (e.g. via suction cups) can only be mounted to one of the non-critical areas and must not obscure any other part of the windscreen.

Note: Devices that are not driver's aids cannot be mounted to the windscreen unless there are adequate measures to ensure that the display is not visible to the driver during vehicle operation.

- A device which is located elsewhere within the cabin of the vehicle (e.g. on top of the dashboard) must not obscure any part of the view through the windscreen, other than the upper and/or lower non-critical areas, as shown in Figure 3.

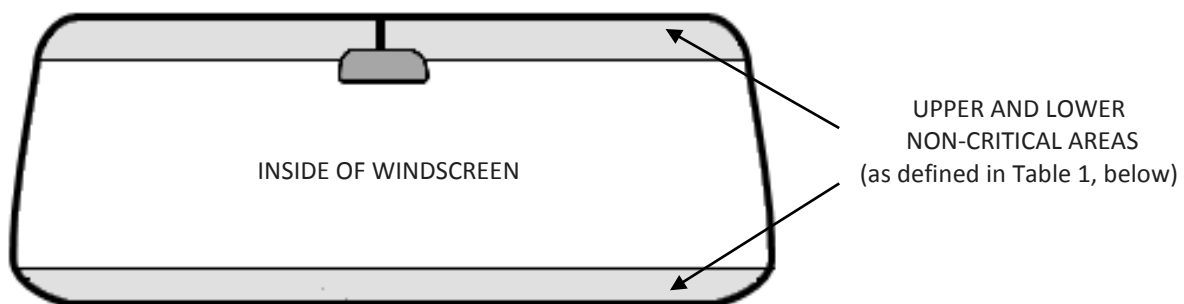


Figure 3: Upper and lower non-critical areas

Table 1: Upper and lower non-critical areas

Area	Definition
Upper non-critical area	The height of the upper area is the larger of: <ul style="list-style-type: none"> the area above the highest point of the windscreen that is swept by a windscreen wiper; and the upper 10% of the windscreen.
Lower non-critical area	This is the lower area of the windscreen above which it is possible for the driver to see: <ul style="list-style-type: none"> the surface of the road 11 metres in front of the driver's eye position (see <i>Figure 4</i>); or if the body shape makes it impossible to see this point on the road, the front edge of the vehicle body.

View through the side and rear windows

The application of VDU devices to the side or rear windows can cause unacceptable safety risks due to:

- obscuring the driver's view of the surroundings
- causing an impact hazard for the head of a vehicle occupant
- (in the case of a driver's aid) the driver having to focus their attention away from the road in front of the vehicle for long enough to read the device.

Therefore:

- VDU devices which are not driver's aids must not obscure or be affixed to any portion of the side or rear windows

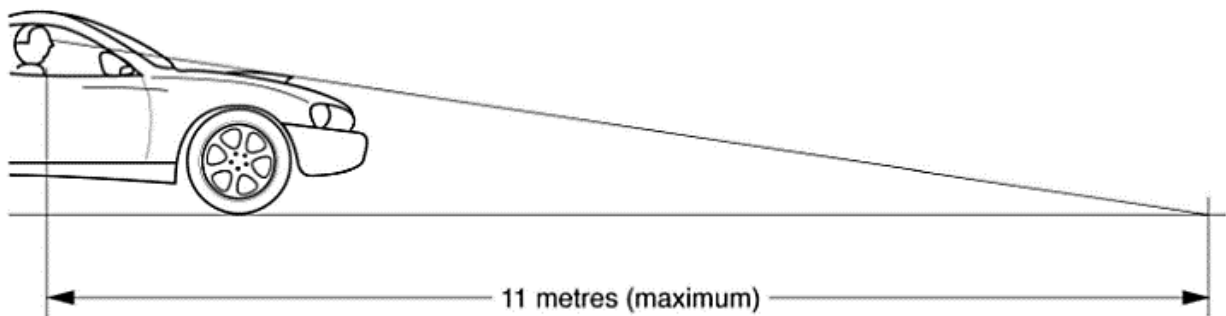


Figure 4: Lower non-critical area

- A VDU driver's aid must not obscure or be affixed to any portion of the side or rear windows, other than an area of non-moving glass adjacent to the driver A-pillar¹ under the following conditions:
 - No attachment to any moving glass
 - No point on the display to be rearward of the dashboard on the driver's side
 - Must not obscure any rear view mirrors
 - Must not interfere with any air bags in the vehicle pillars
 - Must not encroach into the deployment area of a curtain side air bag.

Devices on adjustable mountings

If the driver can modify the physical position of a component of the system (e.g. a VDU device on a flexible mounting) then they must ensure that the device remains in a safe location that does not obstruct their view (in line with the above requirements for the windscreen and the side and rear windows).

Examples:

✓ Good: A display mounted within the instrument panel in such a way that it can be easily viewed by the driver but does not interfere with the field-of-view requirements.

✗ Bad: A display mounted on a long flexible stalk from the upper surface of the instrument panel, which can be adjusted so that the display obscures a substantial part of the external road scene.

¹ The A-pillars on a vehicle hold either side of the front windscreen in place. They are the pillars the driver will see as they look straight at the car from the front.

The following photographs, from the *Crashlab Special Report* cited in the *References* section, provide examples of installations that do not meet the requirements for driver's view.

In particular, it should be noted that the location of the VDU device in *Figure 5* does not look obviously unsafe, but in fact, it obscures the second pedestrian on the right-hand side of the windscreen (partially visible in *Figure 6*).



Figure 5: VDU obscuring a pedestrian



Figure 6: VDU partially obscuring a pedestrian

Obstruction of vehicle controls and displays

The VDU must not obstruct vehicle controls and displays required for driving safely.

Explanation:

The aim of this principle is to ensure that the physical presence of the VDU device does not compromise the driver's ability to use the displays and controls required for driving safely.

This ensures that the driver's ability to be in full control of the vehicle is not affected by installation of the system.

- **Obstruction of controls** in this context means to prevent operation of the relevant controls throughout their intended range of movement, or to make it significantly more difficult to identify, reach and/or operate them.
- **Obstruction of displays** in this context means to render not visible some portion (any portion) of the relevant displays from the driver's normal seating position.

Requirements:

A VDU device must not cause any obstruction to controls or displays that are required for safe driving.

The required controls and displays are those needed to undertake the primary driving task and all those which are mandatory.

- **Required controls include:** accelerator, brake, clutch (if fitted), steering wheel, gear changer, parking brake, horn, light switches, turn indicators, washers and wipers, hazard flashers and demister controls.
- **Required displays include:** the speedometer, all warning lights, mandatory control labels and mandatory tell-tales (dashboard indicator lamps).

Obstruction or impairment of controls and displays not essential to the driving task (e.g. the dashboard clock) should be balanced against the additional benefits provided by the system.

Examples:

✓ **Good:** A route-guidance display integrated into the dashboard in a high central position, which does not obstruct any other displays or controls.

✗ **Bad:**

- An after-market route guidance system which obstructs the light switches
- A VDU device located near the exterior of the steering wheel rim, which could make the steering wheel more difficult to use during cornering.

Avoiding glare and reflections

VDU displays should be located and oriented to avoid glare and reflections.

Explanation:

Glare and reflections that hinder and/or distract the driver's view or make it more difficult to extract information from the display may cause distraction from the driving task. This may lead to increased driver frustration and annoyance and may cause squinting, closing of the eyes for brief periods and head movements to obtain a more comfortable view. All of these effects are likely to reduce driver comfort and, therefore, may compromise road safety.

Glare is the distracting (and potentially disabling) effect of bright light in an otherwise relatively dark scene, which interferes with visual attention and selection. In the in-vehicle context, this can occur in a number of ways:

- External light (usually sunlight) falling on the visual display may reduce display contrast and make the information on the screen more difficult to see from the driver's normal viewing position. This may result in a driver being distracted from the driving task while attempting to read the display
- If the display itself is too bright, it may cause distraction from the road scene and other in-vehicle displays and controls. This is most likely to be apparent to the driver in low ambient light conditions, where the brightness of the screen is adjusted too high. For this reason, the use of a device with automatic brightness adjustment is recommended.

Reflection is the generation of a secondary image of an object, as a result of light from the object reflected from intermediate surfaces. This is relevant in a number of ways:

- Light from a light-emitting display may produce a secondary image of the display screen on the windscreen. This may cause confusion for the driver, who may momentarily mistake the reflection for an object in the field of view. In severe cases, especially if the image on the screen is moving or changing and is in the driver's peripheral field of view, it may cause the driver to startle or initiate evasive action

- Light from an external source (e.g. the sun, street lights, or other bright objects) may be reflected by the display surface into the driver's eyes.

Requirements:

VDU devices should be located and orientated to avoid, or at least minimise, the effects of glare and reflections. These effects should also be considered in the adjustment of settings (e.g. display brightness).

Examples:

✓ **Good:** A screen with an automatic brightness control which is located so as not to produce secondary images on the vehicle's glass and which has a non-reflecting display front surface that can be easily read under all lighting conditions.

✗ **Bad:** A display which is so bright that at night it is distracting in the driver's peripheral vision when looking at the forward road-scene; or the information is difficult to read in sunlight because the contrast is so low.

Interference with safety systems

VDUs must not interfere with the operation of any of the safety systems of the vehicle, such as the air bags.

Explanation:

To maximise safety of the driver and occupants, the operation of the safety systems provided by the vehicle manufacturer must not be impeded or interfered with in any way.

In particular, Supplemental Restraint System (SRS) air bags require a clear 'deployment region' to allow them to properly inflate and perform their occupant protection function in the event of a crash. The installation of VDU (or other) devices in this deployment region may cause the following risks:

- The air bag may be punctured or otherwise prevented from inflating properly due to the presence of the VDU device, and therefore it may not effectively protect the occupant in the event of a crash.
- The rapid inflation of the air bag may launch the VDU device outward at high speed, effectively turning the device into a projectile which causes additional injury to occupants.

Requirements:

Due to the increasing range of vehicle safety systems and technologies, it is not possible to develop guidelines to address these risks in all circumstances.

However, in addition to the use of common sense and caution when considering the location of VDU devices, the following guidelines must be observed at a minimum:

- Do not attach any device to any panel or surface of the vehicle that is marked *SRS* or *Supplemental Restraint System*.
- In the location of all devices, allow a deployment distance of at least 500mm in front of any panel or surface of the vehicle that is marked *SRS* or *Supplemental Restraint System*.

Examples:

✓ **Good:** A rear view camera display which is mounted in a central position on the vehicle dashboard of a 5-seat vehicle (i.e. one that has no central front seat) so that the display unit is not near either the passenger or driver SRS airbags and does not obscure any instruments or controls.

✗ **Bad:** A GPS unit mounted on the panel above the vehicle glove box, where the panel has *SRS* embossed into it, to indicate that there is an air bag behind it.

Intrusion into head impact zone

VDU devices must not intrude into the head impact zone for the driver or passengers and must not constitute any impact risk in the event of a crash.

Explanation:

To preserve the levels of occupant safety provided by the vehicle manufacturer to minimise occupant injury risks in the event of a crash, it is essential that any VDU or other devices installed in the vehicle do not:

- impinge on the 'free space' available in the vehicle for the unimpeded movement of the heads and other body parts of the occupants; or
- have any sharp edges which may injure vehicle occupants.

Requirements:

Australian Design Rule (ADR) 21/00 – Instrument Panel defines safety requirements for the interiors of vehicles, including the absence of sharp edges and the existence of a minimum head impact zone, which must be kept clear of all objects.

When installing VDU or other devices in vehicles, these safety requirements must be maintained. In particular:

- The VDU device must not be installed in any location where there is a possibility of the head or knees of any of the vehicle occupants striking it in the event of a crash (assuming that occupants are properly restrained with seat belts).
- The VDU device, together with any brackets, fasteners or other mounting hardware, must not have any uncovered sharp edges which may be contacted by any part of an occupant in the event of a crash.

Examples:

✓ **Good:** A dispatch display unit, securely installed on top of the dashboard near the windscreen (but not obscuring the driver's critical view area) and well away from the driver's or any other occupant's head impact zone.

✗ **Bad:** A display unit mounted from the vehicle roof near the driver's sun visor, which projects backwards significantly and impinges on the driver's head impact zone.

6. References

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